The Meteorological Magazine

Air Ministry :: Meteorological Office

Vol. 58
June 1923
No. 689

LONDON: PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE.

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Mortyn de Carle Sowerby Salter, 1880-1923

THE Meteorological Office has suffered a sad blow by the sudden death of Mr. M. de Carle S. Salter. Mr. Salter's personality made him a very popular member of the staff, and many of us feel a real personal loss quite irrespective of our official relationships. It is very fitting that Dr. Mill, who has worked so intimately with Mr. Salter and been largely responsible for giving him his sound knowledge of rainfall matters, should write an account of his life and work for this Magazine, but I cannot refrain from recording here on behalf of the staff of the Meteorological Office our deep sense of loss and our sincere sympathy with his family in their great bereavement.

G. C. SIMPSON.

READERS of this Magazine will learn with a sense of personal loss that Mr. Carle Salter died after a very short illness on May 21st. For nearly a quarter of a century no issue of the *Meteorological Magazine* appeared without his collaboration in its production, and latterly it was upon him that the difficult task devolved of adapting the old traditions which had been growing up for sixty years to the new conditions of the post-war world.

Mr. Salter was the son of Mr. M. J. Salter, who was well known as a scientific chemist in London, and his ancestors included several whose names remain familiar in the scientific world, notable amongst them the famous botanist, Dr. Sowerby. After an education at Bancroft's School, Mr. Salter joined the

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staff of the British Rainfall Organization, at 62, Camden Square, in 1897, and thus had for three years the advantage of working under Mr. G. J. Symons, F.R.S., the founder of the voluntary system of rainfall observing in this country. When I joined Mr. Sowerby Wallis as joint-director of the British Rainfall Organization, on the first day of the present century, I found Mr. Salter very competent in the handling of statistics, and later when I had the sole responsibility his eagerness to co-operate in the new style of discussion and calculation based on cartometry was extremely helpful to me in gradually introducing more rigidly scientific methods. He was in many ways an ideal assistant, quick in his intelligent grasp of new ideas, unflagging in his patient mastery of depressing routine and always a student of the scientific principles underlying the operations he was carrying out. He soon became my principal assistant, and year by year I delegated to him more and more of the statistical work required for the annual volumes of *British Rainfall*. From 1912 he became personally responsible for the great General Table of Rainfall, and he took a substantial share in the various discussions.

An important part of the work at Camden Square was the preparation of reports on the rainfall of gathering grounds for projected water-works, which had to be prepared often from scanty data and supported by evidence before Parliamentary Committees. In the inspection of the ground and rain gauges and the testing of the value of particular rainfall records and computing average values, he developed his natural aptitude by diligent and unremitting study. Latterly we adopted the system of working out the probable rainfall of an area, separately, from the same data, one trying to establish the highest, the other the lowest possible value consistent with the data, and then arguing the matter out until by mutual criticism we arrived at the most probable figure. By this means when it came to giving evidence one was prepared for the cross-examination of the most pertinacious counsel.

Thus also I acquired that confidence in his judgment and skill which enabled me, when the time arrived, to hand over to him the work I was not destined to carry on, with perfect confidence in his powers ; and hence to me his death was a double sorrow.

On the breakdown of my health, in 1913, Mr. Salter became joint-director of the British Rainfall Organization, and in effect joint-editor of this Magazine also. When the trained assistants left to take part in the War Mr. Salter remained at his post, only because the state of his health was such that no medical board would pass him for active service. Thus it was that the work of the Rainfall Organization was held together and the publica-

tions kept going by the temporary assistants whom he trained. This involved a very heavy strain on Mr. Salter which he could never have stood but for the constant care with which his wife—a daughter of the late Dr. E. F. Willoughby—watched over his health. The close of the War, unfortunately, brought no relief, as the period of transition immediately preceding and following my retirement, in 1919, involved an even heavier tax on his strength; but he lived to see the great body of 5,000 voluntary observers of rainfall transferred in full working order without loss or discontinuity from the informal conditions of a private institution to the less flexible if more dignified control of a Government Department.

Considering the close and continuous application to routine work which his position entailed it would have been no discredit to Mr. Salter if he had failed to find time for independent work; but he was able to contribute many important papers to the Royal Meteorological Society, on the Council of which he served for many years, and to the Institution of Water Engineers. In these he materially advanced our knowledge of the relation of rainfall to the configuration of the land and also of the fluctuations of general rainfall from year to year. In "The Rainfall of the British Isles" he gave a clear and interesting summary of up-to-date material which should be studied by every rainfall observer. This book shows how thoroughly Mr. Salter had mastered the facts of rainfall distribution, and gave promise of works of wider usefulness in a future which, alas, he was never to see.

Mr. Salter's personal qualities won for him many friends, and he was always a cheerful and entertaining companion and a most loyal colleague. The sympathy of a large number will turn to the widow and only son who formed with him a family circle of rare devotion and affection.

H. R. MILL.

I see by an announcement in to-day's *Times*, the death of the Superintendent of the Rainfall Organization, Mr. Salter, age 42. I realise a loss, a great loss. I feel personally a friend has gone, although I never met him, but his communication has been so pleasant and genial. He was without a doubt an enthusiast and a genius for this work. I express my sincere sympathy with you and the meteorological world at his loss; his memory will be held in high regard.

HENRY A. ROGERS.

3, *Victoria Square, Cotham, Bristol, May 23rd*, 1923.

Many other expressions of appreciation and sympathy have been received.

Sea Temperature, Pressure Distribution and Weather of May, 1923

By C. E. P. BROOKS, M.Sc.

THE abnormally cold and showery weather of May, 1923, in the British Isles, was due to persistent north-westerly winds, associated with a steep pressure gradient between an anticyclone over the North Atlantic and a depression over southern Norway. The mean pressure for the region 50-55° N., 20-30° W., based on 33 wireless reports, was 1,025 mb., or more than 10 mb. above normal, while the mean for Skudesnaes was 1,006·3 mb., or 8·4 mb. below normal. The gradient for northerly winds was actually four times the normal May gradient for westerly winds between the Azores and Iceland.

When we attempt any explanation of unusual weather, it is generally necessary to start a long way back. In this case we appear still to be experiencing the consequences of the abnormal summer of 1921. That summer was marked by open stormy conditions in the Arctic Ocean (1) which set free large quantities of polar ice. This ice, drifting with the east Greenland current, reached the neighbourhood of Iceland in the spring of 1922. In the succeeding months it lowered the temperature of the ocean near Iceland ; in consequence pressure rose there and the tracks of depressions were driven southward causing the unfavourable British summer of 1922 ; a similar action in earlier years has been shown by Brennecke (2). Meanwhile the bulk of the ice rounded Cape Farewell, made the circuit of Davis Strait, and towards the close of 1922 passed into the Labrador Current. The volume, speed and ice-load of the Labrador Current were also increased by the northerly winds westward of Greenland, associated with an intense development of the barometric minimum in the far north-eastern Atlantic during the winter of 1922-23, which will be referred to later. Early in 1923 the Labrador Current carried large quantities of ice into the North Atlantic off Newfoundland (3) ; this and the accompanying cold water helped to lower the temperature of the Gulf Stream.

There was also another reason why the temperature of the Gulf Stream off Newfoundland should be falling about this time. The North-East Trade Wind off the west Coast of Africa drives the surface waters before it as the Trade Wind Drift.

1. Brooks, C. E. P. and Glasspoole, J. *The Drought of* 1921. *London. Q. J. R. Met. Soc.*, Vol. XLVIII., 1922, p. 139.
2. Brennecke, W. *Beziehungen Zwischen der Luftdruckverteilung und den Eisverhältnissen des Ostgrönlandischen Meeres. Ann. Hydrogr., Berlin*, 32, 1904, p. 49.
3. Brooks, Charles F. *The extraordinary meteorological situation in the North Atlantic Region. Worcester, Mass., Bull. American Met. Soc.*, 4, 1923, p. 49.

This turns westward as the North Atlantic Equatorial Current, which is deflected northward by the Coast of America and ultimately forms the Gulf Stream. The average time occupied in the circuit from the Trade Wind region to the north of Scotland is about a year. If the strength of the Trade Wind is temporarily increased, the warm surface waters will be driven forward more rapidly, and as the late Commander Hepworth showed (4), the increase will be followed about a year later by high sea temperatures off the British Isles. Behind this mass of warm water however there will be an area from which the warm surface waters have been driven off and colder underlying waters brought to the surface; hence the initial rise will be followed a few months later by a fall.

Now we find that from December, 1921, to March, 1922, pressure at Horta (Azores) averaged 5 mb. above normal; this corresponds with a decided increase in the strength of the Trade Winds, and accordingly we should expect high sea temperatures north of Scotland in the winter of 1922-23. That this was probably the case is indicated by the fact that from December, 1922, to February, 1923, pressure was abnormally low between Iceland, Norway and the British Isles, since the effect of warm sea is to cause a fall of barometric pressure, while cold sea causes a rise of pressure. In the western Atlantic, behind this area of warm water, the temperature of the Gulf Stream was relatively low, and this combined with the influence of the Labrador Current to produce a mass of cold water off Newfoundland, and to cause an abnormally cold spring in the United States (3). We must first follow the consequences of the high temperature and low pressure north of Scotland. There is a general tendency, illustrated for instance by the Réseau Mondial charts, for areas of abnormally high or low monthly pressure to drift slowly eastwards, with their accompanying weather. Thus Hildebrandsson finds a high correlation between the rainfall of Thorshavn in January to March, and that of Berlin in the following April to September. As the influence of the warm water in the far north-eastern Atlantic penetrates into Europe we may expect pressure there to be below normal, and the low pressure over southern Scandinavia during May is perhaps the beginning of such a process. In the meantime the cold water off Newfoundland, following the course of the Gulf Stream, travelled in an east-north-east direction at about twelve miles a

4. London, Meteorological Office. *The Trade Winds of the Atlantic Ocean.* 1910.
London, Meteorological Office. *Geophysical Memoirs Nos.* 1 *and* 10. *The effect of the Labrador Current upon the surface temperature of the North Atlantic, and of the latter upon air temperature and pressure over the British Isles, Parts I., II. By M. W. Campbell Hepworth,* 1912, 1914.

day and gradually spread its influence over the North Atlantic. In the area 50-55° N, 20-30° W, the mean sea temperature for May was about 2·5° F. below normal, but this point is rather south of the main course of the Gulf Stream, while it is the northern half that would be mainly affected by the Labrador Current. Further north observations are very scarce, but the deficiency of temperature appears to have been greater. The relatively low temperature must have been at least partially the cause of the high pressure over the central Atlantic during May. Some part of the excess may be due to a northward extension of the Azores anticyclone in consequence of the Icelandic minimum being displaced far to the east.

Thus both factors in the cold north-westerly winds of May—the Atlantic anticyclone and the minimum near Scandinavia, appear to be connected with irregularities in the circulation of the Arctic and north Atlantic waters, which first became apparent more than a year ago.

Royal Meteorological Society

THE monthly meeting of the Society was held on Wednesday, May 16th, at 49, Cromwell Road, South Kensington, Dr. C. Chree, F.R.S., President, in the chair.

M. de Carle S. Salter, Superintendent, British Rainfall Organization, and J. Glasspoole, M.Sc., A.I.C.—The Fluctuations of Annual Rainfall in the British Isles considered cartographically.

In the absence of Mr. Salter, who was then seriously ill, Mr. Glasspoole read the paper. He paid a tribute to Mr. Salter's knowledge and long experience of the subject of rainfall.

The paper deals with a series of 54 rainfall maps for the period 1868-1921, each map showing for one year the ratio of the actual rainfall to the average of the 35 years, 1881-1915. The maps are classified into 3 types, indicating respectively (A) excess of orographical rain, (B) deficiency of orographical rain, and (C) excess of cyclonic rain, the typical years of each of these types being (A) 1874, (B) 1919 and (C) 1912. In the earlier portion of the series, years of type (B) or (C) predominate, while towards the end, years of type (A) are slightly more frequent. In the earlier years the maxima are found to be generally in the east; in the middle of the period, in the west; and in the later years, in the south. In every year of the series, some part of the country had more than its average rainfall, and in all but three years, some part had less than the average.

The general rainfall, *i.e.*, the mean percentage for the whole of the British Isles, varied from 137 in 1872 to 77 in 1887, the

Table showing the Annual Rainfall for each year, 1868 to 1921, expressed as a percentage of the average of the 35 years 1881 to 1915

Year	England and Wales	Scotland	Ireland	British Isles	Year	England and Wales	Scotland	Ireland	British Isles
1868	99	113	104	104	1895	96	95	96	95
1869	105	100	98	102	1896	93	99	94	95
1870	82	80	95	84	1897	101	95	114	103
1871	97	92	98	96	1898	87	109	98	95
1872	144	134	128	137	1899	94	106	102	99
1873	89	105	94	94	1900	109	119	115	113
1874	95	108	98	99	1901	88	94	96	92
1875	114	99	99	107	1902	84	86	92	87
1876	117	114	104	113	1903	128	129	124	127
1877	126	131	123	127	1904	89	93	101	93
1878	110	92	96	102	1905	86	97	89	89
1879	109	91	96	100	1906	101	111	93	101
1880	113	86	95	102	1907	99	104	99	100
1881	109	95	100	103	1908	91	99	96	94
1882	127	113	113	120	1909	105	101	23	101
1883	107	106	110	108	1910	113	105	109	110
1884	88	104	98	94	1911	94	99	96	96
1885	101	91	92	96	1912	125	108	108	116
1886	117	94	109	110	1913	98	93	106	99
1887	74	80	77	77	1914	108	103	108	107
1888	98	93	98	97	1915	110	96	102	105
1889	94	85	93	92	1916	114	117	114	115
1890	90	103	97	95	1917	98	97	99	97
1891	111	100	98	105	1918	107	106	111	108
1892	94	96	98	95	1919	105	93	91	98
1893	83	97	82	86	1920	109	105	111	109
1894	108	102	104	105	1921	70	99	88	82

deviation from 100 exceeding 20 in only 5 years, and averaging 8. The sequence of oscillations in the general rainfall is remarkable. From 1868 to 1882 maxima occur at intervals of 5 years, from 1889 to 1909 of 3 years, and from 1910 to 1921 of 2 years. There is also evidence of a long-period fluctuation with two maxima about 40 years apart.

Values for the rainfall expressed as a percentage of the average of 1881-1915 for each year are given in the accompanying table* for England and Wales, Scotland, Ireland and the British Isles. These values were prepared by Mr. Glasspoole, by taking a series of 120 points equally distributed over the British Isles, tabulating the figures from the map for each year and taking

* The Table is not incorporated in the paper presented to the Royal Meteorological Society. The statistics are represented graphically in the paper.

the means. In a few cases in areas of few rainfall records, it was necessary to estimate values from the maps. These general values are probably more accurate than any previously published, since the data available were more homogeneous and since the average referred to is constant.

Annual pressure maps of North West Europe show three main types of variation :—(i) a shift of the south-west wind-drift to the north or south, corresponding with a rise or fall of pressure over the British Isles as a whole ; (ii) a change in the gradient, corresponding with a variation in the pressure difference between north and south ; (iii) local deflections of the isobars. On correlating the general pressure for each year with the general rainfall, the authors find as the correlation coefficient —0·83, so that variations of type (i) appear to be the principal factor in determining the amount of the general rainfall ; the lower the pressure, the higher the rainfall and *vice versa*. As to the variations of type (ii) a measure of the change in the gradient is obtained by taking the difference between the pressure at Dungeness and at Stornoway. This pressure difference is correlated with a certain measure of the comparative wetness of the western and eastern districts, and a correlation coefficient +0·69 is found, indicating that, in years of high pressure gradient, rainfall is comparatively heavy in the west and comparatively light in the east.

The paper deals with the question of the fluctuations of annual rainfall in a much more elaborate manner than has hitherto been possible.

A. W. Clayden, M.A.—(*a*) *An improved Actinograph ;* (*b*) *Note on the influence of a glass shade.*

The first actinograph designed by Mr. Clayden was constructed with two bimetallic coils mounted on a horizontal axis ; one coil was blackened, the other bright ; the movements of a pen were controlled by the two coils in such a way that the heating of one coil moved the pen up the record sheet, the heating of the other moved it down. On exposure to sunshine the blackened coil was heated more than the other, and the curve traced by the pen therefore gave a record of the duration and intensity of sunshine. In the improved form of the instrument the axis of the coils is not horizontal but parallel to the earth's axis. Moreover, the coils are longer and, therefore, a more open scale is obtained.

The instrument is not adapted for the accurate measurement of the intensity of solar radiation, but the records which Mr. Clayden displayed show that it gives an excellent idea of the sequence of changes in the amount of sunshine, so that for many purposes it is to be preferred to the ordinary sunshine recorder.

Capt. E. E. Benest.—Notes on the Sumatras of the Malacca Straits.

An account of this paper was given by Capt. Sir David Wilson-Barker. "Sumatras" appear to be a special form of the ordinary arch squall of the East Indies. These squalls usually blow from the south-west, and are more frequent between the months of April and October. A greater number is experienced between Malacca and Pulo Penang than between Malacca and Singapore; but occasionally the latter place is visited and vessels have been driven ashore there owing to a disregard of local warnings. "Sumatras" always occur at night, and are generally accompanied by thunder, lightning and torrential rain. The strength of the wind is estimated as lying between 40 and 55 miles per hour. A characteristic cloud formation is always observed, exhibiting a heavy arch or bank of cumulo-nimbus, which rises to an estimated height of upwards of 7,000 ft. and rapidly spreads over the whole heavens. The duration of these "Sumatras" seldom exceeds two hours.

Correspondence

To the Editor, *The Meteorological Magazine*

Anti-Solar Rays

With reference to the illustration of the anti-solar rays and the description by Mr. G. A. Clarke, which was published in the February number of the *Meteorological Magazine*, this phenomenon has been long seen and commented upon by residents in the Bechuanaland Protectorate. It is a common sight north of latitude 25° in South Africa. It is sometimes seen quite clearly much south of this, even as far south as Kimberley, latitude 29°. For years past I have observed the rays at sunset; I was first of the opinion that they were the converging shadows of cirrus clouds, but on many occasions these rays have been observed quite clearly when there were no clouds in the sky whatever. I came to the conclusion that they were a contra-reflection of the rays of the setting sun inside the atmosphere, such as might be observed if seen from the inside of a crystal sphere. They would probably become visible under such circumstances if there were a certain amount of atmospheric dust.

Miss Giles of Mahalapye, in Bechuanaland Protectorate, latitude approximately 23° south, has kindly written me a description of the rays as follows:—

> "During February and March these rays were seen almost every evening immediately after sunset, sometimes mere rays of light somewhat like searchlights but of a pinkish hue, sometimes deep rosy pink and at other times paler and

almost yellowy white with a background of blue grey evening sky. When the rays were a deep pink the sky would be of a deep blue, and other times of a pale grey colour. We have on two occasions seen the eastern rays and the rays of the setting sun meeting in the zenith. On one occasion these rays seemed like one continuous arch of lights from east to west. Where they met at the zenith the rays were of a pale colour with a pinkish yellowish tinge."

I may mention that these rays are such a common sight that residents in the Protectorate rarely call attention to the phenomenon.

A. H. WALLIS, C.E.

21, *Egerton Road, Kimberley, South Africa, 30th April*, 1923.

[The possibility of mountains rather than clouds being responsible for the shadow bands has to be remembered. If the phenomenon is observed on consecutive evenings and the rays are in the same apparent positions, the obstructions must be fixed ones.—ED. *M.M.*]

May Weather in 1867 and 1923

IT was stated at the time that the maximum of 81° F. at Kensington on May 4th ultimo was the highest recorded so early in May for 50 years. May I be allowed to draw attention to the really wonderfully close parallel between May, 1923, and May, 1867?

I was then at Cambridge, and remember well the extraordinary burst of heat at the beginning of the month, after a hitherto backward spring. The trees rushed into leaf, the horse chestnuts especially into leaf and flower in a few days. The *Meteorological Magazine* for June, 1867, has abundant detail about this heat spell; as has also *British Rainfall* for that year on pages 58 and 59. Camden Town and Wisbech reported 84° on the 6th, Linton Park 85° on the 7th, and there were many very high maxima on the 8th. But as in the May just ended the early spell of heat was violently and completely reversed, so it was then. In 1923 a terrible thunderstorm and hurricane ravaged north-west France on the 9th, and on the 10th a strong and terribly cold north wind was sweeping over Great Britain. In 1867, on the 10th came an unusually severe series of thunderstorms, from which hardly any part of Great Britain and Ireland escaped. At Cambridge there was a short sharp storm at about 11 a.m., a rapid clearance, and in the late evening a very terrible storm with more than an inch of rain, making a considerable flood in the river Cam. I remember well hurrying to my rooms, while red lightning appeared to be darting across the streets, thankful to be under cover before the rain began.

And then came a fortnight of most bitter weather—frequent showers of hail, sleet and snow, even heavy snowfalls in places, and several destructive frosts, especially from the 21st to the 25th, and even as far south as Bournemouth! But the last few days of that May were mild. This time the bitter Polar winds, whether from west, north or east, have continued without a break to the very end.

It won't do to argue from the later months of 1867 to the months now coming, for the only rule that I have been able to discover about weather parallels is that as soon as attention is called to them they promptly cease!

H. A. BOYS, F.R.Met.Soc.

Spring Hill, S. Mary Bourne, Hants, June 1st, 1923.

NOTES AND QUERIES

The Halley Lecture

THE Halley Lecture was delivered at Oxford on May 17th by Dr. G. C. Simpson, C.B.E., F.R.S., Director of the Meteorological Office, who took for his subject "The Meteorology of Scott's Last March."

The story of the Polar Party which left Hut Point on November 3rd, 1911, reached the South Pole, 900 miles away, on January 17th, 1912, and perished on the return march, was used as a connecting thread for an account of the meteorological conditions met with on the Ross Barrier and on the Polar Plateau.

Attention was drawn to the existence on the Barrier during November of an enormous daily variation of temperature which frequently exceeded a difference of 20 degrees F. between the mid-day and midnight temperatures, although the sun did not then set but circulated from 10 degrees above the southern horizon at midnight to about 30 degrees above the northern horizon at mid-day.

The effect of blizzards on the men and ponies was described and an explanation of the cause of blizzards was given. Dr. Simpson described the effect on the spirits of the party of the discovery that Amundsen had reached the Pole before them, but came to the conclusion that the chief cause of the disaster was the abnormal weather experienced on the return journey.

Just before the party reached the Barrier in the descent from the Plateau, the temperature commenced to fall very rapidly. For 39 days unexpectedly low temperatures were met with owing to an unusual absence of wind which allowed the temperature to fall extremely low. If a blizzard had occurred at this time it would have displaced the cold air, removed the coating of ice crystals from the surface which made sledging very hard and made it possible to run a sail on the sledge. The low

temperatures and heavy pulling overtaxed the strength of the men and was one of the deciding factors in causing the disaster.

The final factor was a blizzard which commenced on March 20th and continued for more than ten days. At this time the party was within eleven miles of a depôt where there was plenty of food and fuel, but they could not leave their tent on account of the high wind and thick drift snow. In consequence they used up their remaining food and by the time the blizzard was over they had all passed away.

The Barometer

A TEN minutes' talk on the Barometer by Lieut-Col. Gold, D.S.O., F.R.S., assistant director of the Meteorological Office, was broadcasted from the London station of the British Broadcasting Company on Thursday evening, May 31st, at 8 p.m. Col. Gold explained briefly the meaning of the millibar and the reasons that induced meteorologists to accept it as the unit of pressure in preference to the pound per square inch when they decided to discontinue giving pressure in units of length, inches or millimetres. He emphasized the practical importance of the fact that pressure at or near sea level is always in the neighbourhood of 1,000 millibars. It is hoped that listeners-in will understand in future what has mystified many of them in the past. In order to enable listeners-in who possess barometers to reduce their observations to Mean Sea Level for comparison with the barometer readings broadcasted each evening, corrections for altitude and temperature which could be easily applied were given. The use of the barometer in determining the pressure distribution over a country and the fundamental importance of the latter in weather forecasting was emphasised. The transmission was satisfactory and listeners-in in the greater London area report that they heard every word distinctly.

It is understood that two further talks will be given in the course of the summer describing the way in which forecasts are made and explaining some recent developments in the art of forecasting weather.

Pilot Balloon Observations in Northern Canada

THE International Meteorological Committee in 1919 recommended that as far as possible, special international investigation of the upper air should be made in co-operation with Roald Amundsen's expedition during the years 1919-1924. Sir R. F. Stupart, in a letter to the Committee, states, that as part of her share in this scheme, Canada sent a specially trained observer in the early summer of 1921 to Fort Good Hope in northern Canada, near the point where the Mackenzie River crosses the

Arctic Circle. With the assistance of two priests he took pilot balloon observations whenever possible throughout the year, and when he left the post in June, 1922, the priests were quite able to continue the balloon work during the coming year. This they agreed to do, so that pilot balloon observations are now being taken regularly at Fort Good Hope.

Transfer of Coastguard Stations to the Board of Trade

IMPORTANT changes have recently been made in the organisation of the former Coastguard Service. There has been for many years a close connection between the work of the Meteorological Office and the Coastguards: they furnished telegraphic reports to the Forecast Division from some of the most important stations round the coast, formerly three times and latterly four times per day, a fourth report at 1 a.m. in the morning having been introduced during the war: they co-operated with the Office in the work of warning seamen of impending gales by hoisting the warning cone when the Forecast Division issued the notification and they contributed readings of the temperature of the sea around the British coasts which were published for many years in the Weekly Weather Report.

On April 1st, 1923, the Coast Guard Service, which has been under the control of the Admiralty since 1856, was suspended and the familiar figure of the Coastguards disappears from our coasts.

The Service has now been divided into three distinct forces:

(1) The Naval Signalling Section.

(2) The Coast Watching Force.

(3) The Coast Preventive Force.

The majority of the former Coastguard Stations have been taken over by the Coast Watching Force which will be under the control of the Marine Department of the Board of Trade. The Naval *personnel* at these stations have been pensioned and in most cases retained as civilian Coast Watchers—the complement at each station, however, having been considerably reduced.

The Board of Trade have undertaken to continue the meteorological observations and returns formerly furnished by the Coastguard. The exhibition of gale warning signals is also being continued, but the re-organisation has led to the closing of certain stations at which gale warning signals were formerly exhibited. In such cases arrangements are being made for the exhibition of signals in neighbouring situations with a view to filling, as far as possible, any gaps which have arisen in the system of warning stations.

The International Symbols ← and ⊹

A CODE of symbols for international use was adopted by the International Meteorological Congress of 1873 at Vienna. The meanings attached to some of the symbols in the reports of the Congress in different languages were not quite consistent, however, and ambiguities still persist.

The symbol ← is a case in point. The French (1) and German (2) texts of the resolution of 1873 interpret the symbol as "Aiguilles de glace" and "Eisnadeln," while the English version (3) gives "Ice-crystals." The latter term appears in all the instructions for observers issued by the Meteorological Office; thus, in *The Observer's Handbook* (4), we find "Ice-crystals ←. Small crystals of ice occasionally fall in winter. They may be distinguished from hail or snow by their shape and size." The practice in America differs however; thus Talman (5), in his list of international symbols, adopts the literal translation "Ice-needles." "Ice needles sometimes seen floating or slowly falling in the air in clear cold weather."

The formation of ice-crystals in the lower layers of the atmosphere under a cloudless sky is not an uncommon phenomenon, and in the polar regions it is frequent. Early explorers were familiar with these floating crystals, and the picturesque term "diamond dust" was in use as early as 1671 (6). In his *Classification of Hydrometeors*, Hellmann (7) calls the phenomenon "snow without clouds," and says that the term "Eisnadeln" was given because large numbers of the crystals are needles, although the presence of other forms has been shown by photo-micrographs. It does not appear that the difference of names here connoted a real difference of practice; the German or French observers appear to have reported all cases of ice-crystals (which were not snow or hail) by the symbol ← in spite of the apparent restrictive character of the names used.

Evidently there is no call for a change in the English practice.

1. Bericht über die Verhandlungen des Internationalen Meteorologen Congresses zu Wien [1873]. Wien, 1873.

2. Rapport sur les Travaux du Congrès international des Météorologistes réunis à Vienne du 2 au 16 Septembre 1873. Vienne 1874.

3. Report of the proceedings of the Meteorological Congress at Vienna [1873]. London 1874.

4. *Observer's Handbook*, 1908 (1st) Edition to 1921 (Current) Edition.

5. Talman, Meteorological Symbols. Monthly Weather Review, 1916, p. 268. This paper contains a valuable summary of the usage in different countries. It is unfortunate, however, that in many cases the forms of the principal International Symbols given without qualification (in Table I.) are not in accordance with the official reports of the International Meteorological Congress at Vienna, at which the symbols were adopted. The original forms are shewn under the heading "Principal Variants."

6. Hellmann, Classification of the Hydrometeors, Monthly Weather Review, 1917, p. 13 (translated by C. Abbe Jr.).

The Director of the Meteorological Office, to whom the question has been referred, wishes it to be known that in future the definition in *The Observer's Handbook* will be amplified as follows:

← *Ice crystals in the air:* these crystals float separately in the air and are usually observed in cold clear weather, when, under suitable conditions, they give rise to halo phenomena.

Another symbol whose meaning is ambiguous is ⊹. According to the three reports the resolution of 1873 defined the symbol as "Snow drift," "Schneegestober," "Bourrasque de neige." The International Meteorological Committee of 1885 at Paris declared the equivalents of the following terms in English, French and German:—

Snowdrift = Chasse de neige = Schneetreiben
Snowstorm = Tourments de neige = Schneegestober

without stating which of these was to be represented by the symbol. The Conference at Munich in 1891 decided to change the English equivalent of "Schneetreiben, Chasse de neige" to "drifting snow" on the ground that "snow-drift" denoted the result and not the act of drifting. But the question what ⊹ represented was still left unanswered. *The Observer's Handbook* interprets the symbol as "snowdrift"; in fact it must be admitted that the resolutions of 1885 and 1891 have so far been ignored.

To meet the difficulty it is proposed to incorporate in future instructions to observers the following definitions:—

⊹ *Drift-Snow.* Drift snow is snow which travels with the wind without settling when it reaches the ground. It may occur with or without new snow falling.

If drift snow occurs without new snow falling the symbol is to be used alone.

If drift snow occurs whilst new snow is falling the two symbols ✳⊹ are to be used together.

International Photographic Survey of the Sky

It has been proposed that an endeavour should be made to obtain a synoptic survey of the skies of north-western Europe, by simultaneous photographs in all parts of the area. The seven days of the week, beginning September 17th, 1923, are indicated as days to be selected for a trial of the enterprise. At least three photographs are wanted for each day, as nearly as possible at the hours of the telegraphic observations, 7h., 13h. and 18h., but it would be preferable if the photographs were repeated each hour.

Observers who are willing to join in this scheme should communicate in the first instance with Sir Napier Shaw (School of Meteorology, Meteorological Office, South Kensington), President of the International Commission for the Study of Clouds.

Review

A DICTIONARY OF APPLIED PHYSICS. Edited by Sir Richard Glazebrook, K.C.B., D.Sc., F.R.S. Vol. IV. *Light-Sound-Radiology.* 8vo, 9×6, pp. viii. + 914. *Illus.* Macmillan and Co. 1923. £3 3*s. net.*

The fourth volume of the *Dictionary of Applied Physics* deals mostly with matters which are not the concern of meteorologists as such. In looking for the meteorology we are led to study interesting articles on a wide range of subjects, from the Quantum Theory to the Mechanism of Moving Pictures. Within our own range we find the articles by Lord Rayleigh on the Scattering of Light by Gases, and by Dr. A. V. Hill on the Mirror Position Finder. There is also a good deal of meteorology in the account of sound-ranging by Professor W. L. Bragg and in the general article on sound by Professor E. H. Barton.

Lord Rayleigh gives an excellent popular account of his father's work and his own, and reproduces some striking photographs. It is interesting to learn that the scattering of light by dust-free air was established independently by three workers—by Cabannes in 1915, by Schmoluchowski in 1916, and by the present Lord Rayleigh in 1918; it was as early as 1899 that the elder Lord Rayleigh showed theoretically that the blue of the sky could be explained by molecular scattering.

Hill's article on the Mirror Position Finder contains many practical details, and serves as a useful reminder of the advantages of this apparatus as an aid to the determination of the movements in the atmosphere. It is fascinating to watch experts using the mirrors to determine cloud height, and there is evidently wide scope for such methods in the study of the transformations of the clouds.

That the practice of sound-ranging, *i.e.*, of locating the position of guns by the measurement of the differences between the times taken by the sound of the discharge to reach various stations, would be affected by meteorological conditions was to be expected. "It was found impossible to make locations when the wind was blowing from our side of the line towards the enemy; the reports of the guns never reached the microphones or were drowned by other noises on our side of the line. On the other hand, when the wind was blowing from the batteries towards the recording stations, the reports were heard clearly and had a sharply marked commencement." The theoretical allowance for wind and temperature is rather troublesome to compute even when it is assumed that the distribution of these elements is known. It was found better to obtain empirical corrections by experiments made day by day at a safe distance from the firing

line, but it is stated that empirical relationships were formulated which could be used when the special installation was not in action. (This is one of the cases where a reference to the place where further details are published would be useful. The Dictionary gives ample references in some articles but none at all in others.)

In Professor Barton's article on Sound, the paragraph (§23) devoted to Long-Range Transit of Sound is based on the work of Tyndall and the late Lord Rayleigh, and perhaps it does not sufficiently take account of the work of meteorologists. Attention should be called moreover to one detail of mathematical interest. In the discussion of the effects of Temperature Gradient it is stated, with reference to an atmosphere with a uniform gradient (such as occurs when the air is in adiabatic equilibrium), " when this state of things prevails it has been shown by the late Lord Rayleigh that the path of a ray of sound through the air is a catenary with vertex downwards." This statement will perpetuate an unfortunate slip of Lord Rayleigh's. Reference to the Theory of Sound* shows that Rayleigh gave the catenary only as an approximation to the path in question. As a matter of fact, the catenary is not even so good an approximation as a circle. The actual curve is a cycloid, as may be seen by examining Rayleigh's equations. The characteristic property of a cycloid is that it is more sharply curved the further from the vertex, whilst the catenary is less sharply curved. Tyndall's theory of " acoustic clouds " is quoted by Professor Barton as the explanation of the bad transmission of sound on certain occasions. It is curious that there is no reference to these " acoustic clouds " in the article on sound-ranging. There is evidently scope for investigation of the relation between audibility and the homogeneity of the atmosphere as regards temperature and humidity. The investigation of Zones of Silence occupies such a large place in meteorological literature that it is disappointing to find only a short paragraph devoted to the subject (and no references). We can not pass the statement that " the difficulties in settling what has been the cause of such phenomena on any particular occasion usually lies in the absence of qualified observers expecting an explosion and listening for it." The real difficulty on the observational side has been to obtain sufficiently detailed information as to the distribution of wind and temperature aloft. Since Fujiwhara has shown how it is to be done, the application of this information in a specific instance should not be difficult.

There is to be one more volume of the great Dictionary, Vol. V., *Metallurgy and Aeronautics.*

F.J.W.W.

* *2nd Edition, London* 1896, Vol. II., p. 132.

Obituary

Captain Carl Hartvig Ryder: died May 3, 1923.—The International Meteorological Committee has lost one of its most active members. Those who took part in its meetings in September, 1921, will remember Captain Ryder's solicitude for the welfare of the international meteorological organisation as developed in the years before the war.

Before his appointment as Director of the Danish Meteorological Service in succession to Paulsen in 1907 Ryder was a naval officer. His personal experiences in meteorology were specially in relation to Greenland and the Arctic. Throughout his tenure of office he maintained his interest in the Arctic and devoted much attention to the annual issue of monthly charts of the polar ice for which the meteorological world is much indebted to the Danish Office. The telegraphic communication with Iceland is another standing memorial of the Danish interest in meteorology. The daily charts of the Atlantic Ocean which were published jointly from 1881 by the Deutsche Seewarte and the Danish Office are a fitting reminder of the previous services in that province by Captain Hoffmeyer, Paulsen's predecessor. We may express the hope that Captain Ryder's death will not impair the intention to bring them up to date. For some years past Captain Ryder suffered from rheumatism and latterly he felt the burden of the administration of the Office in face of the increasing demands of the Danish public and the economic situation. His short final illness was, however attributed to cancer. His death is much regretted by all his colleagues on the International Committee which he joined in 1910 and by many other friends in this country where he was on several occasions a welcome guest.

NAPIER SHAW.

News in Brief

Two new storm signal stations have just been erected in the Thames Estuary, to warn shipping making use of the Thames and the Port of London, of the approach of bad weather. These stations are situated at Cherry Garden Pier, Rotherhithe, and on the lower pierhead at Tilbury.

A wireless station is to be erected on Novaya Zemlya Island by the Russian Authorities according to *The Times* of May 29th. The station will be situated by Matochkin Strait and will be in communication with north Russian and Siberian stations. The *personnel* will include, in addition to the wireless experts and meteorologists, a geologist and a zoologist.

In connection with Mr. Brooks's article on "Sea temperature, pressure distribution and weather of May, 1923," it is interesting to note that according to the officers of the White Star liner "Megantic," the ice conditions in the North Atlantic are at present worse and more dangerous to navigation than they have been for more than twenty years. *The Times* states that after starting from Montreal on May 18th they met with ice of various kinds, close packed, loose and scattered. Two days out after passing Cape Race they sighted one big iceberg. Ice in this region is most unusual after the end of March.

The *Daily Mail* states that during the experiments recently carried out in the laboratory of the General Electrical Company at Pittsfield, Massachusetts, flashes of artificial lightning representing a pressure of 2,000,000 volts jumped a gap 15 feet wide. When the artificial lightning struck some wooden blocks, part of the wood disappeared indicating in the opinion of the engineers the possibility that it had been transformed into a gaseous element.

The Weather of May, 1923

FOR the first week of the month pressure was high over Central Europe and the southern part of the British Isles, so that warm sunny weather with light winds prevailed over England, Ireland, and the greater part of Scotland. Temperature rose locally in the south to between 75° F. and 80° F. and even touched 82° F. on the 4th in London (Camden Square). Following on these conditions there was a drop of about 10 to 20 degrees within a day or two as a low pressure system became established near Scandinavia and a large anticyclone over the Atlantic. Cold northerly winds, often strong in force, swept across the British Isles for the rest of the month, and these were associated with showers of rain, hail, sleet and even snow at times. On the 16th snow was recorded as lying an inch deep at Buxton. There were during this period occasions when temperature remained below 50° F. throughout the day, *e.g.*, the maximum was 49° F. at Kew Observatory on the 12th, 45° F. at Cranwell on the 23rd and 42° F. at Aberdeen and Eskdalemuir on the 11th. Ground frosts occurred repeatedly. Taking however, the, mean values for the month, it is seen that May, 1923, was not exceptional as regards temperature. Sunshine records were poor, the total sunshine at Nottingham for the month being 60 hours below the average, and at London, Falmouth and Aberdeen, 35 to 40 hours below. Some heavy falls of rain occurred locally at various times during the month, 38 mm. being measured in the 24 hours at Snowdon (Llyn Llydaw) and 27 mm. at Aberdeen. Thunderstorms were experienced on two or three days and were fairly general in London and south east England on the 12th and 16th.

[*Continued on p.* 120.

Rainfall Table for May, 1923

CO.	STATION.	In.	mm.	Per-cent. of Av.	CO.	STATION.	In.	mm.	Per-cent. of Av.
Lond.	Camden Square.....	2·28	58	130	*Leics*	Leicester Town Hall...	1·29	33	...
Sur .	Reigate, Hartswood...	3·05	77	...	,, .	Belvoir Castle.....	1·94	49	92
Kent.	Tenterden, Ashenden	3·72	95	...	*Rut* .	Ridlington.....	1·19	30	...
,, .	Folkestone, Boro. San.	...	...	...	*Linc*.	Boston, Skirbeck	1·84	47	105
,, .	Broadstairs	2·55	65	154	,, .	Lincoln, Sessions House	2·89	73	155
,, .	Sevenoaks, Speldhurst.	3·03	77	...	,, .	Skegness, Estate Office.	...	...	...
Sus .	Patching Farm.....	2·85	72	154	,, .	Louth, Westgate	2·34	59	115
,, .	Eastbourne, Wilm. Sq.	2·84	72	171	,, .	Brigg	3·27	83	175
,, .	Tottingworth Park....	4·39	111	...	*Notts.*	Worksop, Hodsock....	3·13	79	157
Hants	Totland Bay, Aston...	2·87	73	166	*Derby*	Mickleover, Clyde Ho..	2·59	66	131
,, .	Fordingbridge, Oaklnds	1·48	38	71	,, .	Buxton, Devon. Hos...	4·85	123	156
,, .	Portsmouth, Vic. Park.	2·89	73	172	*Ches*.	Runcorn, Weston Pt...	4·27	109	185
,, .	Ovington Rectory	2·25	57	96	,, .	Nantwich, Dorfold Hall	3·83	97	...
,, .	Grayshott	3·11	79	145	*Lancs*	Bolton, Queen's Park .	4·31	109	...
Berks	Wellington College...	2·91	74	156	,, .	Stonyhurst College....	4·40	112	154
,, .	Newbury, Greenham..	1·78	45	95	,, .	Southport, Hesketh...	2·44	62	117
Herts.	Bennington House....	1·12	28	59	,, .	Lancaster, Strathspey.	2·79	71	...
Bucks	High Wycombe	2·43	62	138	*Yorks*	Sedbergh, Akay	4·59	117	143
Oxf..	Oxford, Mag. College..	1·26	32	70	,, .	Wath-upon-Dearne ...	2·55	65	126
Nor .	Pitsford, Sedgebrook..	·93	24	49	,, .	Bradford, Lister Pk...	3·39	86	162
,, .	Eye, Northolm.....	·81	21	...	,, .	Oughtershaw Hall	6·39	162	...
Beds.	Woburn, Crawley Mill.	1·63	41	85	,, .	Wetherby, Ribston H..	3·43	87	166
Cam.	Cambridge, Bot. Gdns.	1·18	30	67	*ERY*	Hull, Pearson Park ...	3·68	93	191
Essex	Chelmsford, CountyLab	1·38	35	...	,, .	Holme-on-Spalding ...	2·98	76	...
,, .	Lexden, Hill House...	1·19	30	...	,, .	Lowthorpe, The Elms.	3·30	84	169
Suff.	Hawkedon Rectory ...	1·40	36	76	*NRY*	West Witton, Ivy Ho..	2·44	62	...
,, .	Haughley House.....	1·28	33	...	,, .	Pickering, Hungate ...	2·52	64	...
Norf.	Beccles, Geldeston....	1·29	33	73	,, .	Middlesbrough	2·40	61	125
,, .	Norwich, Eaton	1·28	33	66	,, .	Baldersdale, Hury Res.	...	..	...
,, .	Blakeney	2·15	55	136	*Durh.*	Ushaw College	2·20	56	102
,, .	Swaffham	1·56	40	89	*Nor* .	Newcastle, Town Moor.	2·76	70	136
Wilts.	Devizes, Highclere....	1·31	33	...	,, .	Bellingham Manor....	1·92	49	...
Dor .	Evershot, Melbury Ho.	1·72	44	84	,, .	Lilburn Tower Gdns...	2·80	71	...
,, .	Weymouth,Westham..	1·48	37	91	*Cumb*	Penrith, Newton Rigg..	3·28	83	136
,, .	Shaftesbury, Abbey Ho.	2·09	53	99	,, .	Carlisle, Scaleby Hall .	1·53	39	64
Devon	Plymouth, The Hoe...	2·44	62	118	,, .	Seathwaite	9·33	237	127
,, .	Polapit Tamar	2·87	73	142	*Glam.*	Cardiff, Ely P. Stn.....	2·58	65	103
,, .	Ashburton, Druid Ho..	2·57	65	93	,, .	Treherbert, Tynywaun	4·97	126	...
,, .	Cullompton	1·41	36	65	*Carm*	Carmarthen Friary....	2·99	76	108
,, .	Sidmouth, Sidmount ..	1·50	38	77	,, .	Llanwrda, Dolaucothy.	5·59	142	165
,, .	Filleigh, Castle Hill ...	2·43	62	...	*Pemb*	Haverfordwest, Portf'd	...	...	...
,, .	Hartland Abbey.....	1·62	41	...	*Card*.	Gogerddan.....	5·05	128	191
Corn.	Redruth, Trewirgie ...	3·24	82	140	,, .	Cardigan,County Sch. .	2·46	63	...
,, .	Penzance, Morrab Gdn.	3·17	81	143	*Brec*.	Crickhowell, Talymaes	3·25	83	...
,, .	St. Austell, Trevarna..	3·59	91	148	*Rad* .	Birm.W.W.Tyrmynydd	5·06	129	147
Som	Street, Hind Hayes ...	1·12	28	...	*Mont.*	Lake Vyrnwy	5·42	138	...
Glos..	Clifton College	1·99	50	95	*Denb.*	Llangynhafal	4·48	114	...
,, .	Cirencester	1·37	35	65	*Mer* .	Dolgelly, Bryntirion..	6·48	165	196
Here.	Ross, County Obsy. ...	1·63	41	77	*Carn*.	Llandudno	2·64	67	139
,, .	Ledbury, Underdown.	1·50	38	...	,, .	Snowdon, L. Llydaw 9	11·30	287	...
Salop	Church Stretton.....	2·30	58	89	*Ang* .	Holyhead, Salt Island.	1·23	31	63
,, .	Shifnal, Hatton Grange	2·33	59	113	,, .	Lligwy	1·79	45	...
Staff.	Tean, The Heath Ho...	3·47	88	161	*Man*.	Douglas, Boro' Cem...	2·30	58	91
Worc.	Ombersley, Holt Lock.	1·52	39	74	*Guer*.	St. Peter Port, Grange.	4·37	111	257
,, .	Blockley, Upton Wold.	2·26	57	105	*Wigt*.	Stoneykirk, Ardwell Ho	1·94	49	77
War	Farnborough.....	1·54	39	69	,, .	Pt. William, Monreith .	1·71	43	...
,, .	Birminghm, Edgbaston	1·66	42	78	*Kirk*.	Carsphairn, Shiel.	4·78	121	...

Rainfall Table for May, 1923—*continued*

CO.	STATION.	In.	mm.	Per-cent. of Av.	CO.	STATION.	In.	mm	Per-cent. of Av.
Kirk.	Dumfries, Cargen.....	2·33	59	77	*Caith*	Loch More, Achfary...	11·11	282	253
Dum	Drumlanrig	...	...	...	,, ..	Wick	3·63	92	175
Roxb	Branxholme	1·85	47	82	*Ork .*	Pomona, Deerness	3·97	101	199
Selk .	Ettrick Manse.....	...	...	...	*Shet .*	Lerwick	4·09	104	196
Berk.	Marchmont House	2·16	55	87	*Cork.*	Caheragh Rectory	1·19	30	...
Hadd	North Berwick Res....	1·59	40	80	,, ..	Dunmanway Rectory.	1·31	33	39
Midl	Edinburgh, Roy. Obs..	1·54	39	88	,, ..	Ballinacurra	·81	21	34
Lan .	Biggar	2·68	68	133	,, ..	Glanmire, Lota Lo. ...	1·34	34	55
Ayr .	Kilmarnock, Agric. C..	1·71	43	74	*Kerry*	Valencia Obsy.	...	...	...
,, .	Girvan, Pinmore.....	3·47	88	116	,, .	Gearahameen	5·40	137	...
Renf.	Glasgow, Queen's Pk..	2·23	57	91	,, .	Killarney Asylum.....	3·28	83	107
,, .	Greenock, Prospect H..	3·03	77	88	,, .	Darrynane Abbey	1·73	44	58
Bute.	Rothesay, Ardencr'g..	2·94	75	97	*Wat .*	Waterford, Brook Lo..	1·31	33	56
,, .	Dougarie Lodge	2·83	72	...	*Tip .*	Nenagh, Cas. Lough...	1·47	37	60
Arg .	Glen Etive.....	4·70	119	...	,, .	Tipperary	1·69	43	...
,, .	Oban	2·91	74	...	,, .	Cashel, Ballinamona ..	1·19	30	50
,, .	Poltalloch	3·11	79	108	*Lim .*	Foynes, Coolnanes	1·90	49	82
,, .	Inveraray Castle.....	3·47	88	88	,, .	Castleconnell Rec.	1·72	44	...
,, .	Islay, Eallabus.....	3·41	87	129	*Clare*	Inagh, Mount Callan ..	2·55	65	...
,, .	Mull, Benmore	7·20	183	...	,, .	Broadford, Hurdlest'n.	1·89	48	...
,, .	Mull, Quinish	3·00	76	98	,, .	Newtownbarry.....	1·79	45	...
Kinr.	Loch Leven Sluice	1·68	43	69	*Wexf*	Gorey, Courtown Ho...	...	...	...
Perth	Loch Dhu	2·85	72	63	*Kilk.*	Kilkenny Castle	1·48	37	67
,, ..	Balquhidder, Stronvar.	2·60	66	64	*Wic .*	Rathnew, Clonmannon	·94	24	...
,, ..	Crieff, Strathearn Hyd.	·92	23	37	*Cars.*	Hacketstown Rectory .	1·82	46	70
,, ..	Blair Atholl.....	1·78	45	89	*QCo..*	Blandsfort House.....	...	...	...
,, .	Coupar Angus School..	1·22	31	50	,,	Mountmellick	1·55	39	...
Forf.	Dundee, E. Necropolis.	2·16	55	103	*KCo.*	Birr Castle.....	1·33	34	60
,, .	Pearsie House.....	...	...	...	*Dubl.*	Dublin, FitzWm. Sq...	1·78	45	87
,, .	Montrose, Sunnyside..	2·20	56	108	,, .	Balbriggan, Ardgillan .	1·65	42	79
Aber.	Braemar Bank	4·55	116	190	*W.M*	Athlone, Twyford.....	...	...	...
,, .	Logie Coldstone Sch. ..	5·33	135	214	,, .	Mullingar, Belvedere .	1·57	40	64
,, .	Aberdeen, Cranford Ho	5·18	132	209	*Long*	Castle Forbes Gdns....	1·63	41	63
,, .	Fyvie Castle	6·14	156	...	*Gal .*	Galway, Grammar Sch.	1·39	35	...
Mor .	Gordon Castle.....	4·69	119	221	,, .	Woodlawn	...	...	...
,,	Grantown-on-Spey....	7·15	182	307	*Mayo*	Crossmolina, Enniscoe	3·38	86	104
Na .	Nairn, Delnies.....	2·40	61	133	,, .	Mallaranny.....	2·98	76	...
Inv..	Ben Alder Lodge	4·28	109	...	,, .	Westport House.....	2·55	65	89
,, .	Kingussie, The Birches	4·25	108	...	,, .	Delphi Lodge	4·99	127	...
,, .	Fort Augustus	3·69	94	155	*Sligo*	Markree Obsy.	2·76	70	101
,, .	Loch Quoich, Loan....	7·90	201	...	*Ferm*	Enniskillen, Portora ..	1·86	47	...
,, .	Glenquoich	6·83	173	125	*Arm.*	Armagh Obsy.	1·43	36	60
,, .	Inverness, Culduthel R.	2·79	71	...	*Down*	Warrenpoint	1·52	39	...
,, .	Arisaig, Faire-na-Squir	3·43	87	...	,, .	Seaforde	1·60	41	61
,, .	Fort William.....	4·19	106	109	,, .	Donaghadee	1·11	28	49
,, .	Skye, Dunvegan.....	3·60	91	...	,, .	Banbridge, Milltown .	1·67	42	74
,, .	Barra, Castlebay	1·97	50	...	*Antr.*	Belfast, Cavehill Rd. ..	2·16	55	...
R&C	Alness, Ardross Cas. ..	4·46	113	171	,, .	Glenarm Castle.....	2·21	56	...
,, .	Ullapool.....	5·16	131	...	,, .	Ballymena, Harryville	2·67	68	93
,, .	Torridon, Bendamph..	7·80	198	171	*Lon .*	Londonderry, Creggan	3·19	81	122
,, .	L. Carron, Plockton...	3·55	90	...	*Tyr .*	Donaghmore	1·70	43	...
,, .	Stornoway	3·21	82	125	,, .	Omagh, Edenfel	3·04	77	117
Suth.	Dunrobin Castle.....	...	...	...	*Don .*	Malin Head	1·58	40	80
,, .	Lairg	3·75	95	...	,, .	Letterkenny Hos	3·05	77	109
,, .	Forsinard	...	...	...	,, .	Dunfanaghy	2·34	59	90
,, .	Tongue Manse.....	5·56	141	234	,, .	Narin, Kiltoorish	2·60	66	...
,, .	Melvich School.....	3·95	100	193	,, .	Killybegs, Rockmount.	4·88	124	136

Climatological Table for the British Empire, December, 1922

STATIONS	PRESSURE		TEMPERATURE							Relative Humidity	Mean Cloud Am'nt	PRECIPITATION			BRIGHT SUNSHINE	
			Absolute		Mean Values				Mean							
	Mean of Day M.S.L.	Diff. from Normal	Max.	Min.	Max.	Min.	½ max. and min.	Diff. from Normal	Wet Bulb.			Am'nt	Diff. from Normal	Days	Hours per day	Percentage of possible.
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	%	0—10	mm.	mm.			
London, Kew Obsy.	1011·0	− 2·9	52	29	47·3	39·6	43·5	+ 3·2	41·7	84	7·5	72	+ 14	17	1·4	18
Gibraltar	1022·2	+ 2·6	70	44	62·3	51·5	56·9	+ 0·5	52·3	75	4·3	124	− 16	8	...	...
Malta	1017·8	+ 1·9	63	46	58·3	51·8	55·1	− 2·1	51·5	83	5·4	90	+ 4	14	4·5	46
Sierra Leone	1011·9	+ 0·7	91	65	87·1	73·8	80·5	− 1·0	74·8	73	5·7	41	+ 4	5	...	...
Lagos, Nigeria	1010·2	− 0·3	89	69	88·0	74·7	81·3	0·0	77·4	75	6·7	22	+ 1	3	...	...
Kaduna, Nigeria	1011·4	− 1·4	93	51	88·9	57·4	73·1	+ 0·7	56·2	35	0·9	0	− 3	0	...	...
Zomba, Nyasaland	1010·0	+ 1·4	94	58	83·5	64·8	74·1	+ 1·4	...	85	5·1	277	− 14	18	...	...
Salisbury, Rhodesia	1009·4	− 0·5	93	52	83·0	59·5	71·3	+ 1·4	64·4	61	5·0	175	+ 29	15	...	...
Cape Town	1016·0	+ 1·7	94	47	78·5	59·3	68·9	+ 1·3	64·3	63	4·3	4	− 18	3	...	...
Johannesburg	1012·4	+ 1·5	86	50	77·3	54·9	66·1	+ 1·0	57·1	63	4·8	126	+ 3	20	8·2	60
Mauritius	1014·8	+ 0·8	92	66	84·7	70·0	77·4	− 0·9	71·2	70	4·7	14	−106	13	10·3	77
Bloemfontein	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Calcutta, Alipore Obsy.	1015·1	− 0·6	83	52	77·2	57·2	67·2	+ 0·7	58·2	81	1·3	0	− 5	*0	...	...
Bombay	1013·7	+ 0·4	89	63	84·6	69·6	77·1	− 0·2	66·1	71	1·2	4	+ 2	*1	...	...
Madras	1013·8	+ 0·3	84	62	82·8	66·8	74·8	− 1·7	70·0	79	2·9	9	−149	*1	...	...
Colombo, Ceylon	1011·7	+ 1·9	88	65	85·7	70·2	77·9	− 1·8	73·0	63	3·7	90	− 50	7	...	...
Hong Kong	1020·0	+ 0·1	74	47	66·8	57·4	62·1	− 0·8	55·2	64	6·2	19	− 12	5	5·1	48
Sandakan	...	...	90	73	86·9	74·6	80·7	+ 0·6	76·6	80	....	357	− 92	17	...	...
Sydney	1007·5	− 4·4	104	58	80·6	64·6	72·6	+ 2·6	65·5	59	4·6	37	− 30	11	8·1	56
Melbourne	1007·2	− 5·3	97	49	76·5	55·3	65·9	+ 1·6	59·2	56	6·4	51	− 8	10	6·5	43
Adelaide	1008·6	− 4·6	103	50	79·6	59·2	69·4	− 1·8	58·8	50	4·9	75	+ 51	10	8·4	58
Perth, W. Australia	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Coolgardie	1008·5	− 2·7	100	48	86·2	56·8	71·5	− 4·3	59·7	35	2·8	3	− 15	2	...	...
Brisbane	1009·0	− 2·9	97	65	86·3	69·2	77·7	+ 1·3	72·3	68	5·3	117	− 8	10	...	...
Hobart, Tasmania	1004·0	− 5·7	88	44	67·7	52·1	59·9	− 0·5	53·7	64	7·7	133	+ 83	20	5·5	36
Wellington, N.Z.	1008·2	− 3·9	77	42	68·6	55·7	62·1	+ 1·6	56·6	70	7·0	19	− 63	9	6·0	40
Suva, Fiji	1008·0	− 0·6	91	62	85·5	71·4	78·5	− 0·4	77·2	83	6·9	408	+100	21	...	...
Kingston, Jamaica	1015·2	+ 1·0	92	66	87·6	69·4	78·5	+ 0·8	...	68	5·9	2	− 39	2	...	...
Grenada, W.I.	1013·8	+ 1·9	85	71	82·4	72·6	77·5	− 0·6	72·1	73	4·1	140	− 48	19	...	...
Toronto	1019·2	+ 1·8	60	6	34·9	21·9	28·4	+ 2·2	25·0	60	6·8	44	− 28	13	...	...
Winnipeg	1017·8	− 0·1	36	−26	9·6	− 4·4	2·6	− 3·1	1·6	...	5·7	35	+ 11	15	...	...
St. John, N.B.	1018·4	+ 4·2	45	−13	29·0	11·6	20·3	− 4·1	18·5	67	7·0	128	+ 22	17	...	...
Victoria, B.C.	1013·6	− 3·2	55	21	40·2	33·8	37·0	− 4·5	35·4	91	8·4	182	+ 32	24	....	...

* For Indian stations a rain day is a day on which 0·1 in. (2·5 mm.) or more rain has fallen.

Climatological Table for the British Empire for the Year 1922

STATIONS	PRESSURE		TEMPERATURE							Relative Humidity	Mean Cloud Am'nt	PRECIPITATION			BRIGHT SUNSHINE	
			Absolute		Mean Values				Mean							
	Mean of Day M.S.L.	Diff. from Normal	Max.	Min.	Max	Min.	½ max. and min.	Diff. from Normal	Wet Bulb.			Am'nt	Diff. from Normal	Days	Hours per day	Percentage of possible.
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	%	0—10	mm.	mm.			
London, Kew Obsy.	1014·5	— 0·7	87	26	55·9	42·6	49·3	— 0·4	46·6	75	6·7	569	— 37	163	4·0	31
Gibraltar	1018·2	+ 1·7	95	42	70·5	57·9	64·2	+ 0·1	58·7	75	3·9	657	— 253	72	...	...
Malta	1016·0	+ 1·2	93	41	70·5	61·5	66·0	+ 0·8	60·3	74	4·1	300	— 161	70	7·5	60
Sierra Leone	1012·3	+ 0·5	95	65	86·6	73·7	80·2	— 0·7	74·4	73	5·6	3909	— 8	185	...	...
Lagos, Nigeria	1010·9	— 0·5	92	67	86·2	75·1	80·6	+ 0·4	†75·9	†82	†9·2	2145	+ 325	135	...	...
Kaduna, Nigeria	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Zomba, Nyasaland	1012·1	0·0	99	48	81·0	61·0	71·0	+ 1·9	...	80	4·4	687	— 724	98	...	...
Salisbury, Rhodesia	1011·5	— 2·6	96	32	81·4	52·9	67·1	+ 1·8	58·4	54	...	605	— 203	70	...	...
Cape Town	1017·2	+ 0·2	102	34	71·5	53·5	62·5	+ 0·4	58·0	68	4·6	483	— 166	102	...	...
Johannesburg	1016·2	+ 0·1	86	23	70·9	49·8	60·4	+ 0·9	50·3	62	3·4	706	— 94	112	8·8	74
Mauritius	1015·9	— 0·2	92	55	79·8	66·7	73·3	— 0·7	68·1	76	5·2	1689	+ 428	220	7·8	65
Bloemfontein	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Calcutta, Alipore Obsy.	1007·0	— 0·5	103	51	88·0	71·0	79·5	+ 0·8	...	...	...	2106	+ 538	*84	...	...
Bombay	1008·6	— 0·5	94	60	86·7	75·3	81·0	+ 0·5	...	...	...	1802	— 24	*110	...	...
Madras	1008·2	— 0·6	110	61	91·5	74·9	83·2	+ 0·3	...	...	...	1669	+ 414	*97	...	...
Colombo, Ceylon	1010·2	+ 0·8	95	65	86·8	74·6	80·7	— 0·5	76·5	69	7·0	2230	+ 74	169	...	...
Hong Kong	1011·8	— 0·8	93	44	77·1	68·8	72·9	+ 0·6	67·8	77	7·1	1763	— 350	154	5·5	45
Sandakan	...	...	92	72	87·2	75·1	81·1	— 0·2	...	...	...	3863	+ 815	162	...	...
Sydney	1014·4	— 1·5	104	39	72·6	56·4	64·5	+ 1·5	59·1	64	4·5	1000	— 224	136	6·8	56
‡Melbourne	1014·8	— 1·5	105	32	67·6	49·5	58·6	+ 0·2	...	66	5·8	...	...	...	...	...
Adelaide	1015·7	— 1·4	109	37	72·6	53·2	62·9	— 0·1	54·4	56	4·9	587	+ 55	117	7·0	57
‡Perth, W. Australia	1016·1	— 0·3	106	37	73·1	54·6	63·8	— 0·2	...	...	...	...	...	...	...	...
Coolgardie	1015·0	— 1·0	112	32	77·7	51·8	64·8	+ 0·3	56·1	44	3·8	273	+ 15	48	...	...
Brisbane	1014·4	— 1·3	99	39	78·5	60·2	69·3	+ 0·4	64·2	66	4·0	908	— 249	109	...	...
Hobart, Tasmania	1012·1	— 0·5	97	31	62·3	47·1	54·7	+ 0·4	49·6	68	6·4	718	+ 116	190	6·0	50
Wellington, N.Z.	1015·2	+ 1·1	82	31	62·6	49·2	55·9	+ 0·5	...	74	6·3	741	— 491	150	5·5	45
Suva, Fiji	1010·8	— 0·6	91	55	83·8	68·7	76·3	— 0·7	74·3	83	6·5	4016	+1162	201	...	...
Kingston, Jamaica	1014·1	+ 0·2	93	65	88·2	70·9	79·5	+ 0·2	...	73	5·3	278	— 583	59	...	...
Grenada, W.I.	1013·6	+ 1·2	90	68	83·7	73·6	78·7	0·0	73·8	75	4·6	1685	— 242	250	...	...
Toronto	1017·5	+ 1·1	93	— 7	56·8	39·3	48·1	+ 3·7	42·3	69	5·1	740	— 110	143	...	...
Winnipeg	1016·1	— 0·1	96	—38	48·7	28·6	38·7	+ 4·4	35·3	...	4·9	543	+ 26	109	...	...
St. John, N.B.	1015·5	+ 0·8	78	—14	48·3	33·5	40·9	— 0·3	37·8	77	6·1	1179	— 41	145	...	...
Victoria, B.C.	1017·4	+ 1·0	87	21	54·4	42·5	48·5	— 1·0	44·6	83	5·6	557	— 270	140	...	...

* For Indian stations a rain day is a day on which 0·1 in. (2·5 mm.) or more rain has fallen. † Mean of observations at 9h. only.
‡ Missing values for one month interpolated.

Continued from p. 115.]

The weather of the past month, as indicated in telegrams to "The Times," is marked by numerous records of heavy rains and floods. In western Europe the weather was cold and rainy, with hail in northern France on the 10th and snow following heavy rain in the Gex region (Haute Savoie) on the 13th. In Italy, after intense heat in the early days of May, cold winds carried the temperature much below normal, and there were fresh falls of snow in the Alps. Floods were reported from the Volga Valley during the month. On the 25th and 26th there were several floods on the Tigris and Euphrates, and on the 29th unusually heavy rain was reported at Sheikh Othman, in the Aden hinterland, causing floods at Lahej, which has not happened for twelve years. In Kenya Colony there have been exceptionally heavy rains during the past two months, and all the rivers are in flood. Near Colombo the "Okara" foundered in a cyclone, about the 7th.

There has been much ice in the St. Lawrence Estuary and in the North Atlantic off Newfoundland, causing accidents to several vessels. Other accidents have been due to fog. In New Brunswick there were very heavy floods at the beginning of the month. On the 9th a storm swept the North Central United States, bringing snow as far west as North Dakota and as far south as Kentucky. It was followed by a heavy frost. On the same day San Bernardino, California, experienced the record May temperature of 101° F. and the first thunderstorm of the year was experienced in New York. On the 14th a tornado in Colorado City, Texas, caused damage and loss of life. It was accompanied by a "cloudburst."

There were good rains in eastern and southern Australia early in the month, which partly broke up the drought. At the same time heavy rains in South Island, New Zealand, caused disastrous floods.

The special message from Brazil states that in the north of the country rainfall averaged about 80 mm. below normal while in the centre and south the distribution was irregular. The month was characterised by an extremely active atmospheric circulation with numerous rapidly-moving high pressure areas and secondaries. A bad storm was experienced at Rio de Janeiro on the 27th. Temperature was generally above normal except in the extreme south. Crops are in good condition. At Rio de Janeiro pressure was 2·1 mb. above normal and temperature 1·6° F. above.

Rainfall. May, 1923; General Distribution

England and Wales ...	121	per cent.	of the average	1881-1915.
Scotland	130	,,	,,	,,
Ireland	77	,,	,,	,,
British Isles	115	,,	,,	,,